

The genus *Ondinea* (Nymphaeaceae) including a new subspecies from the Kimberley region, Western Australia

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Abstract

Kenneally, Kevin F. and Schneider, Edward L. The genus *Ondinea* (Nymphaeaceae) including a new subspecies from the Kimberley region, Western Australia. Nuytsia 4 (3): 359-365 (1983). A new subspecies, *Ondinea purpurea* Hartog subsp. *petaloidea* is described and illustrated. The occurrence of previously unreported petaloid flowers in the genus and the discovery of seedlings necessitates expanding the species description. The gradation from sepals to petals to petaloid stamens to conventional stamens provides additional morphological data to support the placement of *Ondinea* in the Nymphaeaceae *sensu stricto*.

Introduction

Ondinea purpurea is a poorly known dicotyledonous aquatic perennial restricted to sandstone streams of the northern Kimberley region (Gardner District, Northern Botanical Province; Beard 1980) of Western Australia. The first collection of the plant was made by C. A. Gardner from the Prince Regent River system during his 1921 Kimberley Expedition. Subsequent collections which extended the known range were made by Leutert from near Kalumburu Mission (den Hartog 1970) and Hnatiuk and Kenneally (1981) from tributaries of the Mitchell River. This monotypic genus was described by den Hartog (1970) who considered *Ondinea* to be similar to *Nymphaea*, differing primarily in the absence of an aril, carpellary appendages (styles), a corolla and a stigmatic cup, and the presence of a conspicuously extended floral axis. Schneider and Ford (1978) examined the seed anatomy and morphology of *O. purpurea* and provided additional data to support den Hartog's alignment of *Ondinea* with *Nymphaea*. Recent field work by us has revealed a petaloid form of *Ondinea* which warrants recognition as a new subspecies. The presence of petals in the genus provides further support for the placement of *Ondinea* in the Nymphaeaceae. In addition, the discovery of seedlings of *O. purpurea* enables them to be described for the first time (Figure 1A). Further studies on the gross morphology and floral biology of *Ondinea* will be published elsewhere (Schneider, in press).

Taxonomy

Ondinea Hartog, Blumea 18: 413 (1970)

Type: *O. purpurea* Hartog

A monotypic genus confined to sandstone streams of the Kimberley region, Western Australia.

Ondinea purpurea Hartog, loc. cit.

Type: Kimberley district, Kurunundalo or Kurunundalu, 3 miles [4.8 km] North-East of Kalimburu [Kalumburu], Western Australia, W. Leutert 108 (holo: sheet no. 3, CANB. 171930).

Emergent *perennial* with leaves and pedicels all arising directly from a tuber. *Tubers* 1-6, linearly arranged, erect, oblong, 1.5-2.5 cm long x 1-2 cm wide, the youngest covered at the top with fine fibrous hairs. *Roots* (some contractile) 1-1.5 mm thick, unbranched or with a few small side branches, descending from the upper part of the tuber. *Petioles* 10-40 cm long (or more where waters are deeper or tubers are deeply buried), 1 mm thick, sheathed at the base. *Submerged leaf-blade* deeply cordate, 10-17 cm long, thin, translucent, glossy, yellow-green above and often \pm purplish-brown below, with entire and crispate margins; *apex* obtuse or emarginate and with a small mucro; basal lobes obtuse, 3.5-5(6) cm long x 1-1.5 cm wide with a 45°-90° divergence between them; nerve system reticulate with the main nerves apparent on the undersurface; both leaf surfaces bearing sparsely distributed small papillae, the papillae becoming more numerous close to the main and secondary nerves. *Emergent leaf-blade* floating, narrow ovate, c. 7 cm long x 2 cm broad, leathery bright light-green above and purplish below, with entire and only slightly undulate margins; basal lobes overlapping or almost so, obtuse, 2-2.5 cm long; *nerve* similar to that of submerged leaves. *Pedicels* terete, slightly tapered below flower, 4-60(-300) cm long, 3-6 mm wide, white below water, green above, pink to purple toward base of flower; emergent portion of pedicel 15-25 cm long with numerous longitudinal tannin stripes and fine papillae. *Flowers* solitary. *Sepals* 4, linear or slightly spatulate, 9-33 mm long and c. 1/6 as wide, obtuse, slightly convex, papillose, purple-violet on the adaxial surface, pink on the abaxial, reflexed during anthesis, spreading to erect when in fruit. *Petals* 0-4 (infrequently 5), alternating with sepals, oblong-elliptic, 13-26 mm long, 2-6 mm wide (at base), light to dark purple on both surfaces, 5 major veins, the midvein prominent. *Stamens* 15-34, inserted in close whorls at top of ovary; *filaments* broadly to narrowly oblong, 1-6 mm long becoming larger and petaloid centrifugally, with 3-5 parallel major veins, the outer veins terminating at margins below loculi, the midvein continuing upward through the connective; *loculi* purple-red to purple-brown-red, bisporangiate, lateral, dehiscent laterally; terminal appendage absent. *Ovary* oblong-ellipsoid, 5-9 mm long, 5 mm wide, 3 to 14 locules each with numerous 60(\pm 20) ovules; outer wall (floral cup) purple-red to pink. *Stigmatic lobes* 3-14, whorled around prominent projecting floral axis, ventral surfaces free and forming a shallow carpellary (stigmatic) cup approximately 2 mm wide; *ventral surface* purple-red and velvet-like, papillose composed of stigmatic secretory cells. *Floral axis* cylindrical 2.5-8 mm long (from base of stigmatic cup); 1-2 mm wide, swollen distally, yellow or yellow-green, rarely green. *Fruit* an ovoid berry 10-20 mm long, 8-15 mm wide, with alternating green and purple longitudinal stripes; pericarp peeling transversely around fruit to expose locules. *Seeds* numerous, broadly ellipsoidal, c. 1 mm long with fine longitudinal striations observed at low magnification, surrounded by mucilage, brown, with a translucent aril derived from funicular outgrowth covering half the seed. *Seedlings:* shoot more or less elongating and swelling at tip to form a primary tuber, this giving rise to a rosette of leaves and adventitious contractile roots; *petiole* 20 mm long and 0.5 mm wide; *lamina* linear to very narrowly oblong, apiculate, 25 mm long and 5 mm wide.

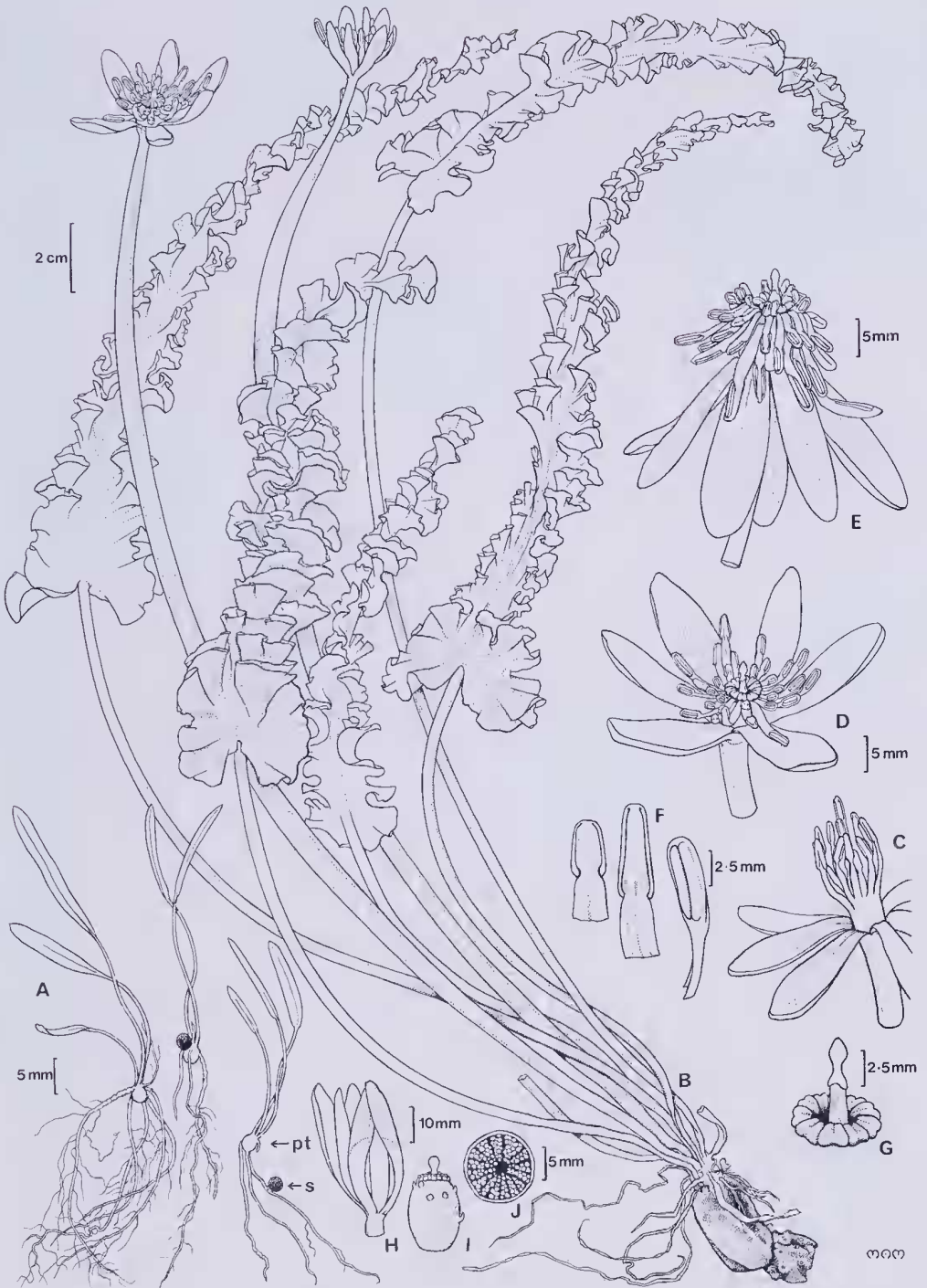


Figure 1. A—Seedling of *Ondinea purpurea* subsp. *purpurea* (s—seed; pt—primary tuber). B to J—*Ondinea purpurea* subsp. *petaloidea*. B—Habit. C to E—Flowers. F—Stamens. G—Stigmatic cup with projecting floral axis. H—Fruit enclosed by perianth. I—Fruit. J—Fruit (T.S.)

A from K. F. Kenneally 8179; B—J from Schneider s.n. (the Type).

Key to the subspecies of *Ondinea*

Petals absent, sepals less than 18 mm long, stamens 15. subsp. *purpurea*

Petals present, sepals more than 14 mm long, stamens 27-34 subsp. *petaloidea*

subsp. *purpurea* (Figure 1A)

Sepals 4, 9-17 mm long, 1.5-3 mm wide, obtuse, slightly convex. *Petals* absent. *Stamens* 15, on the upper part of the ovary; often spirally attached, 1-6 mm long. *Ovary* oblong-ellipsoid, 5-9 mm long. *Floral axis* 2.5-3 mm long. *Fruit* 14-17 mm long and 8-11 mm wide.

Other specimens seen. WESTERN AUSTRALIA: Creeks near the Prince Regent River, C. A. Gardner 1353 (PERTH); Lushington Creek, Prince Regent River, C. A. Gardner 9651 (PERTH); 3 mi (4.8 km) W of Kalumburu Mission on road to Pago, N. Kimberley, 25 April 1981, A. Harris s.n. (PERTH, K); Camp Creek, Mitchell Plateau, N. Kimberley, K. F. Kenneally 7114 (CANB, K, PERTH); Gauging Station, Camp Creek, Mitchell Plateau, N. Kimberley, K. F. Kenneally 8179 (PERTH, TEX); Near rockhole of the jump-up to Karunundalu, 3 mi (4.8 km) NE of Kalumburu Mission, 10 December 1968, J. & W. Leutert s.n. (PERTH); 1.5 mi (2.4 km) N Kalumburu Mission, G. C. Taylor 58 (PERTH).

Distribution. Known only from a few non-perennial creek systems extending from Kalumburu to the Prince Regent River in the Gardner District, Northern Botanical Province of Western Australia.

Ecology. Populations exhibiting emergent (floating) leaves are apparently restricted to the Kalumburu (type) area and have not been observed elsewhere. The illustration provided by den Hartog (op. cit. 414) is based on a specimen with leaves intermediate between submerged and emergent. The leaves illustrated are sagittate with long narrow divergent lobes.

subsp. *petaloidea* Kenneally et Schneider, subsp. nov. (Figures 1 B-J and 2 A-C)

Differt a subspecie typica partibus omnibus majoribus, sepalis quoque et alabastris majoribus, numero staminum, petalis evolutis.

Typus: Small non-perennial tributary to Mitchell River, approx. 27 km NW of CRA mining camp, Mitchell Plateau, N. Kimberley (14°41'40''S, 125°40'30''E), 21 January 1982, E. L. Schneider s.n. (holo: PERTH; iso: CANB, K, NY, PERTH, TEX).

Robust *perennial*. *Sepals* 4, 15-33 mm long and 5-13 mm wide at base. *Petals* 1-4(5), oblong-elliptic, 13-26 mm long and 2-6 mm wide at base, obtuse. *Stamens* 27-34 inserted in close whorls at top of ovary, 2-16 mm long and 0.5-4 mm wide. *Ovary* oblong-ellipsoid, 8 mm long and 5 mm wide. *Floral axis* 5-8 mm long and 1-2 mm wide. *Fruit* oblong-ellipsoid 1-1.5 cm wide and 1-2 cm long.

Other specimens seen. Represented only by the type collection.

Distribution. Known only from a few non-perennial creeks in the type locality Mitchell River region, Northern Kimberley, Western Australia.

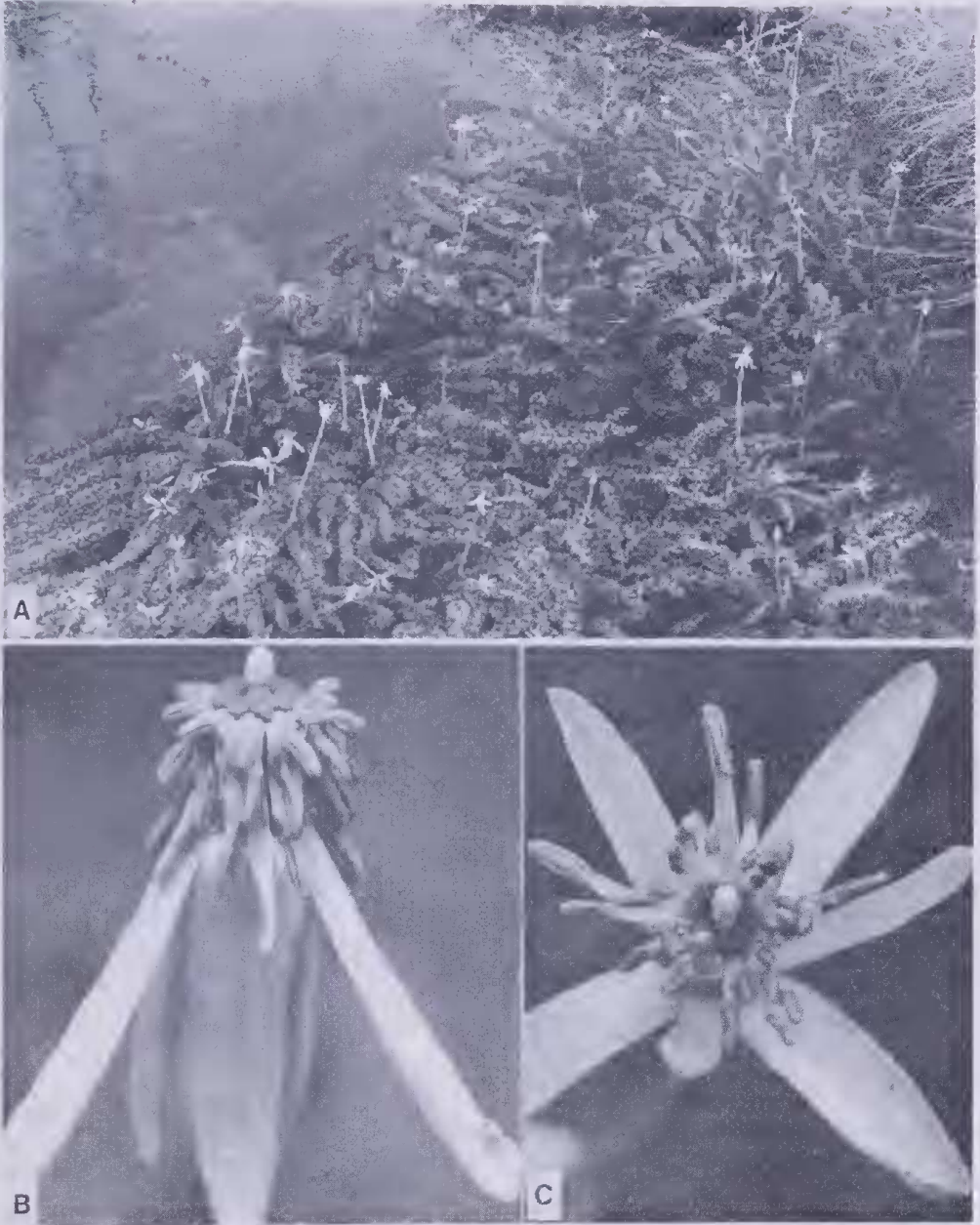


Figure 2. *Ondinea purpurea* subsp. *petaloidea*. A—Habitat. B & C—Flowers.

Ecology. *Ondinea purpurea* subsp. *petaloidea* is known to occur in several streams dissecting the King Leopold Sandstone portion of the Mitchell River drainage system. These streams are non-perennial, flowing during the summer wet (December-April) and becoming dry by winter (June). During the dry winter months

the oblong tubers (c. 2-5 cm x 1-2 cm) can be found embedded in the alluvial sand of the open stream-bed or in crevices among large sandstone boulders at depths of 4-45 cm. The texture of the alluvial substrate is 98% sand, 1% clay and 1% silt. The soil is further characterized by possessing a low organic content (0.2%).

From field observations it appears that young (small) tubers are shallowly rooted in the sandy soils. The presence and activity of conspicuous contractile roots which arise near the apex of the tuber, however, pulls the enlarging tubers deep into the loose sandy soil, with the result that the largest, hence oldest, tubers occupy the deepest soil levels.

Discussion. *Ondinea* is a tuberous dicotyledon whose mature gross morphology, although not immediately reminiscent of nymphaeaceous s. str. architecture, exhibits vegetative, floral, and reproductive characteristics related to those of both *Hydrostemma* Wallich (= *Barclaya*; see Mabberley 1982) and *Nymphaea*.

The structural similarities between *Ondinea* and *Nymphaea* (e.g. morphological gradations from perianth through androecial members, gynoecial cups, stigmatic papillae, pollen, fruit and seed anatomy) together with similar pollination and seed dispersal syndromes lend strong support to den Hartog's placement of the former genus in the Nymphaeaceae. Further support for the inclusion of *Ondinea* in the Nymphaeaceae s. str. comes from comparative studies of stem vascularization (Weidlich pers. comm.). That *Ondinea* is closely related to *Nymphaea*, as suggested by den Hartog, is also supported on the aforementioned grounds. Whether *Ondinea* is more closely related to *Nymphaea* than other nymphaeaceous genera, especially the Indo-Malesian water lily *Hydrostemma* (Hu 1968, Stone 1978), remains unresolved. Investigations dealing with floral development and vascularization in *Ondinea* and *Hydrostemma* are presently underway and may assist in the elucidation of generic interrelationships.

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References

- Beard, J. S. (1980). A new phytogeographic map of Western Australia. W. Austral. Herh. Res. Notes No. 3, 37-58.
- den Hartog, C. (1970). *Ondinea* a new genus of Nymphaeaceae. Blumea 18: 413-417.
- Hnatiuk, R. J. and Kenneally, K. F. (1981). A survey of the vegetation and flora of Mitchell Plateau, Kimberley, Western Australia. In: 'Biological survey of Mitchell Plateau and Admiralty Gulf, Kimberley, Western Australia.' (W. Austral. Museum: Perth.)
- Hu, S. Y. (1968). The genus *Barclaya* (Nymphaeaceae). In: Studies in the flora of Thailand 48. Dansk. Bot. Arkiv. 23: 535-540.
- Mabberley, D. J. (1982). William Roxburgh's botanical description of a new species of *Swietenia* (Mahogany) and other overlooked hinomials in 36 vascular plant families. Taxon 31: 65-73.
- Schneider, E. L. (In press.) Morphological studies of the Nymphaeaceae XIV. Gross morphology and floral biology of *Ondinea* den Hartog. Austral. J. Bot.
- Schneider, E. L. and Ford, E. G. (1978). Morphological studies of the Nymphaeaceae. X. The seed *Ondinea purpurea* den Hartog. Bull. Torrey Bot. Club 105: 192-200.
- Stone, B. C. (1978). *Barclaya*, the Malaysian "water lily". Malayan Nat. September issue pp. 20-22.